film of, for example, Cu, Ag, Pt, Au, Rh, Ir, Ni or the like, or an alloy consisting essentially of those metals such as AuCu, CuCr or the like; Ni, an Ni-based alloy, NiFe, an NiFe-based alloy or the like such as those described in JP-A 9-229736; or Ru, Ti or the like, or an alloy consisting essentially of those metals.

Where the antiferromagnetic layer 143 is of a Cr-based antiferromagnetic alloy film, the underlayer 142 may be any of those mentioned above. For the underlayer 142, also suitable is any of bcc-phase metals of Cr, V, Fe and the like, or of alloys consisting essentially of those metals.

The pinned magnetic layer 144 is of a three-layered film, which comprises two layers of a ferromagnetic layer B, 1441, and a ferromagnetic layer A, 1443, as antiferromagnetically coupled to each other via an antiferromagnetically coupling layer 1442 existing therebetween. It is desirable to interpose a nonmetallic element such as oxygen, nitrogen or the like between the ferromagnetic layer B and the antiferromagnetic layer 143 or between the ferromagnetic layer B and the longitudinal bias film of the antiferromagnetic film, as producing large resistance change. In that case, the thickness of the interlayer into which the nonmetallic element is incorporated is preferably from 0.2 to 2 nanometers. For example, preferred is a structure of ferromagnetic layer A (or ferromagnetic layer B)/oxide layer/ferromagnetic layer B (or

ferromagnetic layer A) in which an oxide interlayer is disposed between the ferromagnetic layers A and B.

The antiferromagnetically coupling layer 1442 may be of a metal of Ru, Rh, Ir or Cr. Preferred are Ru having an extremely large antiferromagnetically-coupling function; Ru capable of exhibiting its antiferromagnetically-coupling function in a broad film thickness range; and Cr capable of exhibiting its antiferromagnetically-coupling function in a broad film thickness range. The thickness of the antiferromagnetically coupling layer is not specifically defined, provided that it is suitable for making the layer exhibit its antiferromagnetically-coupling function. For this, referred to is the disclosure in Phy. Rev. Lett., 67, (1991), 3598.

Fig. 21 is a graph of residual magnetization ratio, Mr/Ms, indicating the reduction in the antiferromagnetic coupling capability of the antiferromagnetically coupling layer of Ru after thermal treatment, relative to the thickness of the Ru layer. In this, the antiferromagnetic coupling layer of Ru is to couple a ferromagnetic layer of Co and a ferromagnetic layer of a CoFe alloy. Mr/Ms = 1 means that the coupling layer of Ru has completely lost its antiferromagnetic coupling capability; and Mr/Ms = 0 means that the antiferromagnetic coupling of the ferromagnetic layers by the coupling layer of Ru is in a complete condition.

As in Fig. 21, it is understood that the thickness of the antiferromagnetic coupling layer of Ru is preferably from more than 0.8 nanometers up to 1.2 nanometers. With its thickness falling within the defined range, the characteristics including the antiferromagnetically-coupling function of the antiferromagnetic coupling layer of Ru are not degraded in any thermal treatment at 250 to 300°C which may be needed for settling the magnetization direction of the pinned magnetic layer 144 or may be needed in any other steps of fabricating heads and which often induces mutual diffusion between the coupling layer and the neighboring ferromagnetic layers B and A. If the thickness of the Ru layer is not larger than 0.8 nanometers, some attention must be paid to the mutual diffusion to cause the degradation of the antiferromagnetically-coupling function of the Ru layer. On the other hand, if the thickness is larger than 1.2 nanometers, the antiferromagnetic coupling of the layers B and A by the Ru layer will be difficult. Where the antiferromagnetically coupling layer is of Cr, its thickness is also preferably from more than 0.8 nanometers up to 1.2 nanometers for the same reasons as those for the Ru layer. The ferromagnetic layers B and A are preferably of Co or a Co-based alloy.

Where the ferromagnetic layers B and A are of a $Co_{1-x}Fe_x$ alloy ($0 < x \leq 0.5$), a large magnetic coupling coefficient could be ensured to them with the antiferromagnetic layer 143